

Demographic and Socioeconomic Characteristics of Glaucoma Suspects in a Tertiary Care Center of Pakistan

Muhammad Sadiq¹, Yousaf Jamal Mahsood², Waqar Ahmad³, Mir Azam Khan⁴, Farah Akhtar⁵
^{1,3,4}University of Malakand, ²Khyber Girls Medical College, Hayatabad Medical Complex, Peshawar
⁵Al-Shifa Trust Eye Hospital

ABSTRACT

Purpose: To describe the demographic characteristics of Glaucoma Suspects (GS) presenting to the glaucoma clinic in a tertiary care settings.

Study Design: Descriptive observational study.

Place & Duration of Study: Glaucoma clinic of Al-Shifa Trust Eye Hospital, Rawalpindi, from September 2015 to February 2016.

Methods: Patients attending the glaucoma clinic were examined and intraocular pressure (IOP), iridocorneal angles, anterior and posterior segments evaluation, vertical cup-to-disc ratio (vCDR) were measured. Retinal nerve fiber (RNFL-Global) thickness was calculated by the Optical Coherence tomography machine using software version 6.0.9. Subjects qualifying as glaucoma suspects were interviewed for demographic and systemic conditions. All the information was recorded on a predesigned proforma and descriptive statistics was used for analysis.

Results: A total of 876 patients were examined. Eighty-two (9.36%) patients fulfilled the criteria of GS. There were 57.3% females and mean age of sample was 56.78 ± 12.83 (Range 40 – 70 years). Hypertension was found in 34.1% (n = 28) and diabetes in 25.6% (n = 21). Other diseases were asthma, depression, cardiac and gastric problems. Most of the patients belonged to lower or upper lower class, which represents a huge number on socioeconomic status scale. Mean IOP (both eyes) was 13.93 ± 3.23 mmHg (range 6 – 22 mmHg). Only 5% of subjects had vCDR of > 0.8. RNFL-Global of 79 (48.2%) eyes were within normal limits.

Conclusions: Majority of GS belong to lower or lower middle socioeconomic class. The health authorities must focus on this issue to provide easily accessible diagnostic facilities for reducing the economic burden of this problem.

Key Words: Glaucoma suspects; Glaucoma; Pakistan; Intraocular pressure.

How to Cite this Article: Sadiq M, Mahsood YJ, Ahmad W, Khan MA, Akhtar F. Demographic and Socioeconomic Characteristics of Glaucoma Suspects in a Tertiary Care Center of Pakistan. Pak J Ophthalmol. 2023, 39 (1): 55-60.

Doi:10.36351/pjo.v39i1.1499

Correspondence: Yousaf Jamal Mahsood
Khyber Girls Medical College
Hayatabad Medical Complex
Peshawar
Email: yousaf82@hotmail.com

Received: October 05, 2022
Accepted: November 28, 2022

INTRODUCTION

Glaucoma is a progressive optic neuropathy that results in loss of retinal ganglion cells (RGCs) and consequently thinning of retinal nerve fiber layer (RNFL). These changes lead to permanent loss of visual field and eventually blindness. Glaucoma is the leading cause of irreversible blindness worldwide and it is estimated that by 2040 111.8 million people will be affected by this disease.¹ Globally, in 2010 the

glaucoma-related blindness was 2.1 million and the visual impairment was 4.2 million.² Literature shows that if we detect glaucoma at an early stage, irreversible damage from this disease can be prevented.^{3,4} Different systemic, as well as ocular risk factors, have been proposed which are linked to increased prevalence of glaucoma. Some of these factors are increasing age, positive family history, African-American race, increased intraocular pressure (IOP), myopia, and thin cornea.^{5,6}

Glaucoma specialists are sometimes encountered with a situation where a clear diagnosis of glaucoma cannot be made. Glaucoma Suspects (GS) are those individuals, who have any one of the characteristics of glaucoma but do not completely fit in its definition.⁷ Ocular Hypertension Study (OHTS) was a randomized trial that reported the risk of developing glaucoma in these subjects.⁸ Since then there has been a lot of research on glaucoma suspects worldwide but local data is scarce in this regard. Bowling et al reported that 5% of total referrals to glaucoma service were GS.⁹ Burden of glaucoma suspects lack any compelling evidence in our setup. In tertiary care eye hospitals, majority of patients are referred from peripheral areas. Early diagnosis and timely management is the main objective to prevent blindness related to glaucoma. The rationale of this study was to investigate demographic characteristics of glaucoma suspects who visited glaucoma clinic of a tertiary care eye hospital. This research will help understand the impact of GS on our health system and it can be used for guidance of health care professionals as well as policymakers. It will also create opportunities to carry out more research on other aspects of this topic.

METHODS

This descriptive observational study was conducted in the Out-Patient Department (OPD) of glaucoma clinic of Al-Shifa Trust Eye Hospital, Rawalpindi. Formal permission from the ethical committees of Hospital and University of Malakand was sought. We adhered to the tenets of Helsinki declaration. The inclusion criteria of subjects were age group of 20 – 70 years, both genders presenting to glaucoma clinic during the study period (from September 2015 to February 2016). Using nonprobability consecutive sampling technique, all the patients presenting to glaucoma clinic during the study period were examined by either of the two glaucoma specialists. They were asked about history of systemic diseases, past ocular medical or surgical

history, any glaucoma patient in the family, and use of steroids. A detailed slit-lamp ocular examination including gonioscopy was carried out using Zeiss 4 mirror gonioscopy lens. Goldmann applanation tonometer was used to record intraocular pressure (IOP). A detailed fundus examination as well as assessment of the optic disc was done by slit-lamp biomicroscope using 90 D lens. Retinal Nerve Fiber Layer (RNFL) thickness was measured using Optical Coherence tomography machine (Spectralis, Heidelberg GmbH, Heidelberg Germany) software version 6.0.9. RNFL-Global was recorded for each eye and analyzed.

Glaucoma suspects were defined according to the American Academy of Ophthalmology Primary Open-Angle Glaucoma Suspect Preferred Practice Pattern.⁷ It defines GS as an individual who has open angles on gonioscopy and has one of the following characteristics:

1. Appearance of the optic disc or retinal nerve fiber layer that is suspicious for glaucomatous damage.
2. A visual field suspicious for glaucomatous damage in the absence of clinical signs of other optic neuropathies.
3. Persistent elevated intraocular pressure (IOP) associated with normal appearance of the optic disc and nerve fiber layer and normal visual fields.

Keeping the frequency of GS as 5% from previous study,⁹ confidence level of 95% and absolute precision of 5%, the total sample size of glaucoma suspects was calculated as 73.

Subjects who qualified for enrollment were interviewed. Information was gathered from the subjects directly or through their attendants (by taking prior consent) and recorded on a specially designed proforma. A detailed history was taken about the socioeconomic and demographic variables (including age, gender, weight, height, education, occupation, monthly income, and tobacco use). History of any systemic disease and medication was also noted. Blood pressure was taken in the sitting position at the right upper arm. Body-weight was measured to the nearest 0.1 kg, and height was measured to the nearest cm with bare feet. Body mass index (BMI) was calculated from body-weight and height.

Socioeconomic status was measured by evaluating variables like education level, occupation, and monthly income by using the scale of Kuppuswamy urban which was further modified by different

researchers.¹⁰ Classes of socioeconomic status were presented as lower, upper-lower, lower-middle, upper-middle, and upper class.

All of the data was evaluated by using SPSS (Inc. Released 2008. SPSS Statistics for Windows, Version 17.0. Chicago: SPSS Inc.) Software. Frequencies of all categorical variables were calculated and represented in the form of tables and figures. Categorical variables like age group, educational status, BMI, OCT findings, vertical cup-to-disc ratio (vCDR), and monthly income in Pakistani Rupees (PKR) were calculated in 3 or more categories and rest were binary. For quantitative variables like age (in years) and IOP (in mmHg), mean and standard deviations (SD) were calculated to represent the central tendency and dispersion.

RESULTS

During six months, a total of 876 patients were examined in the glaucoma clinic. Eighty two (9.36%) patients fulfilled the criteria of GS. There were 57.3% females and mean age of sample was 56.78 ± 12.83 (Range 40 – 70 years). Demographic details are depicted in Table 1.

Table 1: Demographic and Socioeconomic Factors of our study group. Monthly income indicates the income of the patients or upon which they were dependent.

Variables	Responses	Frequency (n = 82)	Percentage
Patient category	Zakat (charity/free of cost)	56	68.3
	Subsidized	26	31.7
Gender	Male	35	42.7
	Female	47	57.0
Age Group (years)	Less than 40	10	12.2
	40 to 60	40	48.8
	61 to 70	22	26.8
	More than 70	10	12.2
Educational Status	No formal education	30	36.6
	1-5 years	16	19.5
	6-10 years	29	35.4
	11-14 years	5	6.1
	More than 14 years	2	2.4
Body Mass Index (BMI)	Underweight	3	3.7
	Normal	44	53.7
	Overweight	20	24.2
Tobacco Use	Obese	15	18.3
	Using Tobacco	13	15.9
	Not Using Tobacco	69	84.1
Economic	Self	27	32.9

dependence	Dependent on family	55	67.1
	Up to 10000	25	30.5
Monthly income (PKR)*	10001-20000	32	39.0
	20001-30000	12	14.6
	30001-50000	6	7.3
	> 50000	2	2.4

PKR = Pakistani Rupee.

Figure 1 shows hypertension was found in 34.1% (n = 28) and diabetes in 25.6% (n = 21). Other diseases were asthma, depression, cardiac and gastric problems.

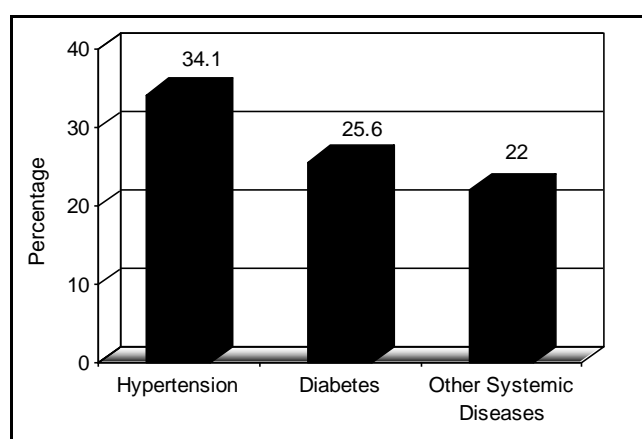


Figure 1: Status of systemic disease in the study population.

Most of the patients belonged to lower or upper lower class which represents a huge number of socioeconomic status scale (Table 2).

Table 2: Socioeconomic status of our subjects. It was calculated based on the Kuppaswamy scale.

Scale	Socioeconomic Status	Number of Patients	Percentage %
26 – 29	Upper	00	00
16 – 25	Upper-Middle	3	3.7
11 – 15	Lower-Middle	5	6.1
5 – 10	Upper-Lower	38	46.3
< 5	Lower	36	43.9
Total		82	100

The mean IOP (both eyes) was 13.93 ± 3.23 mmHg (range 6–22 mmHg). Distribution of patients according to vCDR is shown in figure 2.

RNFL-Global of 79 (48.2%) eyes were within normal limits (Figure 3).

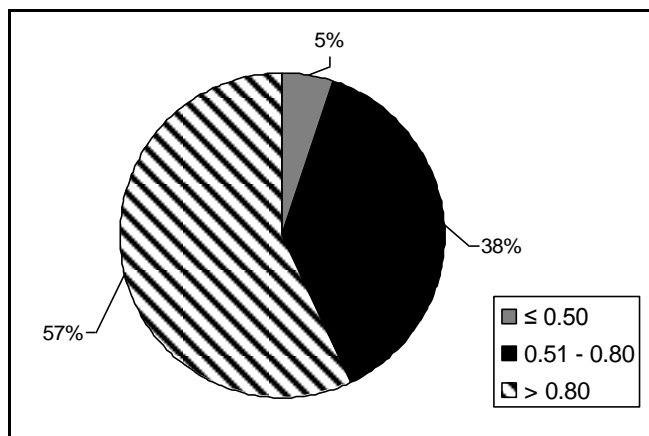


Figure 2: The vertical cup-to-disc ratio (vCDR) of our sample as detected clinically by using a 90 D lens. Only 5% of subjects had vCDR of > 0.8.

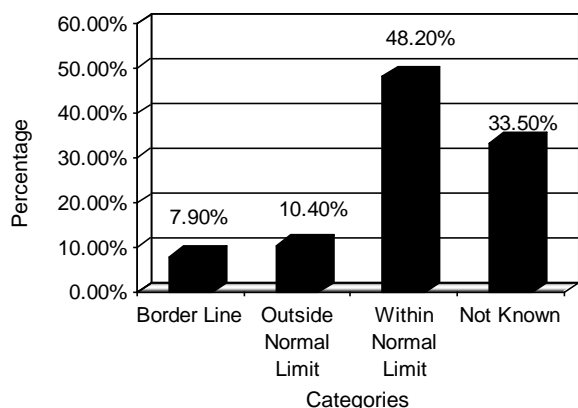


Figure 3: RNFL-Global thickness as measured by OCT machine (Spectralis, Heidelberg GmbH, Heidelberg Germany).

DISCUSSION

In this paper, we have discussed the demographic, ocular, and systemic factors associated with GS in our setup. There were 9.36% patients who were diagnosed as GS. A range of 4 to 10% has been found in literature.¹¹⁻¹⁴ Bowling et al reported that 5% of total referrals to glaucoma service were GS.⁹ Ocular hypertension (OHT), defined as IOP > 21 mmHg without any glaucomatous damage is itself a risk factor for conversion to Primary open-angle glaucoma (POAG). In our study, the mean IOP was 13.94 ± 3.24 mmHg (range 6 – 22 mmHg) which means IOP > 21 mmHg was not found in many cases. The Los Angeles Latino Eye Study reported OHT in 1.7% – 7.4% of cases.¹⁵ While Bowling et al found it in 29.8% of their subjects.⁹ The reason for this difference can be speculated from the fact that this study was conducted in glaucoma clinic where most of the cases are referred

for glaucoma management. Secondly, 60% of our sample population consisted of patients with less than 60 years of age. Previously published data has shown OHT in 1.32%.¹⁶ A community-based study is needed to know the actual prevalence of OHT in Pakistan.

Ocular Hypertension Treatment Study (OHTS) reported that 9.5% of their study participants developed glaucoma in 5 years or roughly 2% per year.¹⁷ Kim et al, reported that 23.7% of their GS patients developed glaucoma at a rate of 4.75% per year over 5 years.¹⁸ Lim et al, had different results of conversion, 2.6% per year in their population.¹⁹ This variation between the results is because of a different definition of glaucoma suspects used in these studies such as OHT, POAG suspects, and NTG suspects.

RNFL thickness was within normal limits in 48.2% of our subjects. These results need attention as they have strong implications in glaucoma care. The normative database of OCT machine is taken from a different population and we also did not consider the refractive status of the subjects in our study which might be the cause of shift towards borderline or outside normal limits of RNFL thickness. Myopic subjects have thinner RNFL than normal and the image quality of the OCT scan is affected by the refractive error of the subject.²⁰ There is compelling evidence that subjects with thinner RNFL at baseline are 1.5 times more prone to develop glaucoma than normal.²¹

The vertical cup-to-disc ratio (vCDR) in the majority (95%) of our cases was more than 0.50. Progressive optic disc cupping is a sign of glaucomatous optic neuropathy and evidence supports that regular optic disc examination must be done in suspects to detect early glaucoma.²² Thus, subjects with thinner RNFL, higher IOP and increased vCDR need to be observed more carefully than others.

Most of our patients (68.3%) were from the zakat (Charity) category. This highlights a big problem of poverty that every 2 out of 3 patients in our study were poor and could not afford the expenses of consultation. We can find similar findings from the economic dependence of our patients where 67.1% were dependent on their families. The monthly income of 69.5% of our study group was ≤ 20,000 PKR, which is the maximum income of a laborer in Pakistan. Even worse was the case with the educational status of our patients, where 91.5% of subjects had ≤ 10 years of formal education. Poverty, economic dependence on family and lack of basic education are the main

challenges faced by our patients. These challenges negatively affect the care of our patients. In this study, we highlight the issue of long-term glaucoma care in case of conversion to glaucoma.

Systemic risk factors like hypertension and diabetes were the most common medical problems detected in our study. Considering the financial burden, these factors further compromise the health of our patients. This is because all of the three i.e. glaucoma, hypertension, and diabetes are lifelong problems. In our study, about half (42.5%) of our patients were either overweight or obese and there is convincing evidence that people with higher BMI have higher IOP and hence more at risk of glaucoma.^{23,24}

The strength of our study is that it provides local data about the demographic, economic and systemic factors associated with glaucoma suspects in Pakistan. This information will be helpful for ophthalmologists as well as researchers in future. The limitations are descriptive design, single-center results, and shorter duration of the study. In future, we recommend conducting multi-center or community-based research to know the actual burden of glaucoma suspects in our country. We also suggest the glaucoma awareness campaigns should be started for general public for early and regular checkup of their eyes.

CONCLUSION

Majority of GS belong to lower or lower middle socioeconomic class. The health authorities must focus on this issue to provide easily accessible diagnostic facilities for reducing the economic burden of this problem.

Conflict of Interest: Authors declared no conflict of interest.

Ethical Approval

The study was approved by the Institutional review board/Ethical review board (**Ref: 501/EC/ASTEH**).

ACKNOWLEDGEMENTS

We highly acknowledge the cooperation and support of glaucoma department, Al-Shifa Trust Eye Hospital, Rawalpindi – Pakistan. Special thanks to Dr. Saima Jabeen for her support in data collection. There is no funding or financial support and conflict of interest to declare for this paper.

REFERENCES

1. **Tham Y-C, Li X, Wong TY, Quigley HA, Aung T, Cheng C-Y.** Global prevalence of glaucoma and projections of glaucoma burden through 2040: a systematic review and meta-analysis. *Ophthalmology*, 2014; **121 (11)**: 2081-2090. <https://doi.org/10.1016/j.ophtha.2014.05.013>
2. **Bourne RR, Taylor HR, Flaxman SR, Keeffe J, Leasher J, Naidoo K, et al.** Number of people blind or visually impaired by glaucoma worldwide and in world regions 1990–2010: a meta-analysis. *PLoS one*, 2016; **11 (10)**: e0162229. <https://doi.org/10.1371/journal.pone.0162229>
3. **De Moraes CG, Liebmann JM, Levin LA.** Detection and measurement of clinically meaningful visual field progression in clinical trials for glaucoma. *Progress Ret Eye Res.* 2017; **56**: 107-147. <https://doi.org/10.1016/j.preteyeres.2016.10.001>
4. **Saunders LJ, Medeiros FA, Weinreb RN, Zangwill LM.** What rates of glaucoma progression are clinically significant? *Expert Rev Ophthalmol.* 2016; **11 (3)**: 227-234. <https://doi.org/10.1080/17469899.2016.1180246>
5. **Friedman DS, Wilson MR, Liebmann JM, Fechtner RD, Weinreb RN.** An evidence-based assessment of risk factors for the progression of ocular hypertension and glaucoma. *Am J Ophthalmol.* 2004; **138 (3)**: 19-31. <https://doi.org/10.1016/j.ajo.2004.04.058>
6. **Garg P, Singh L, Malhotra R, Lisa M.** A study on systemic risk factors for primary open angle glaucoma. *Int J Life Sci Pharma Rev.* 2014; **4 (2)**: 2250-0480.
7. **Prum BE, Lim MC, Mansberger SL, Stein JD, Moroi SE, Gedde SJ, et al.** Primary open-angle glaucoma suspect preferred practice pattern® guidelines. *Ophthalmology*, 2016; **123 (1)**: P112-P151.
8. **Kass MA, Heuer DK, Higginbotham EJ, Johnson CA, Keltner JL, Miller JP, et al.** The Ocular Hypertension Treatment Study: a randomized trial determines that topical ocular hypotensive medication delays or prevents the onset of primary open-angle glaucoma. *Arch Ophthalmol.* 2002; **120 (6)**: 701-713. doi:10.1001/archophth.120.6.701
9. **Bowling B, Chen S, Salmon J.** Outcomes of referrals by community optometrists to a hospital glaucoma service. *Br J Ophthalmol.* 2005; **89 (9)**: 1102-1104. <http://dx.doi.org/10.1136/bjo.2004.064378>
10. **Patro BK, Jeyashree K, Gupta PK.** Kuppaswamy's socioeconomic status scale 2010—the need for periodic revision. *Indian J Pediatr.* 2012; **79 (3)**: 395-396. DOI 10.1007/s12098-011-0517-7
11. **Banks J, Perkins E, Tsoulakis S, Wright J.** Bedford glaucoma survey. *Br Med J.* 1968; **1 (5595)**: 791. Doi: 10.1136/bmj.1.5595.791
12. **Hollows F, Graham P.** Intra-ocular pressure, glaucoma, and glaucoma suspects in a defined population. *Br J Ophthalmol.* 1966; **50 (10)**: 570. Doi: 10.1136/bjo.50.10.570

13. **Leibowitz HM, Krueger D, Maunder LR, Milton R, Kini M, Kahn H, et al.** The Framingham Eye Study monograph: An ophthalmological and epidemiological study of cataract, glaucoma, diabetic retinopathy, macular degeneration, and visual acuity in a general population of 2631 adults, 1973-1975. *Surv Ophthalmol.* 1980; **24 (Suppl)**: 335-610.
14. **Quigley HA, Vitale S.** Models of open-angle glaucoma prevalence and incidence in the United States. *Invest Ophthalmol Vis Sci.* 1997; **38 (1)**: 83-91.
15. **Brown MM.** Prevalence of Open-Angle Glaucoma and Ocular Hypertension in Latinos: The Los Angeles Latino Eye Study. *Evidence-Based Ophthalmol.* 2005; **6 (1)**: 14-15.
<https://doi.org/10.1016/j.optha.2004.01.025>
16. **Mahsood YJ NM, Ahmad H.** Clinical Audit of Patients Presenting at Department of Glaucoma as Part of Glaucoma Fellowship. *Al-Shifa journal of ophthalmology*, 2017; **13**: 7.
17. **Gordon MO, Beiser JA, Brandt JD, Heuer DK, Higginbotham EJ, Johnson CA, et al.** The Ocular Hypertension Treatment Study: baseline factors that predict the onset of primary open-angle glaucoma. *Arch Ophthalmol.* 2002; **120 (6)**: 714-720.
[Doi:10.1001/archoph.120.6.714](https://doi.org/10.1001/archoph.120.6.714)
18. **Kim YK, Choi HJ, Jeoung JW, Park KH, Kim DM.** Five-year incidence of primary open-angle glaucoma and rate of progression in health center-based Korean population: the Gangnam Eye Study. *PloS one*, 2014; **9 (12)**: e114058.
<https://doi.org/10.1371/journal.pone.0114058>
19. **Lim JH, Park JS, Lee SY, Hong YJ.** Incidence of and risk factors for glaucoma in lost-to-follow-up normal-tension glaucoma suspect patients. *BMC ophthalmology*, 2016; **16 (1)**: 1-7.
[DOI 10.1186/s12886-016-0245-x](https://doi.org/10.1186/s12886-016-0245-x)
20. **Rauscher FM, Sekhon N, Feuer WJ, Budenz DL.** Myopia affects retinal nerve fiber layer measurements as determined by optical coherence tomography. *J Glaucoma*, 2009; **18 (7)**: 501.
[Doi: 10.1097/IJG.0b013e318193c2be](https://doi.org/10.1097/IJG.0b013e318193c2be)
21. **Lalezary M, Medeiros FA, Weinreb RN, Bowd C, Sample PA, Tavares IM, et al.** Baseline optical coherence tomography predicts the development of glaucomatous change in glaucoma suspects. *Am J Ophthalmol.* 2006; **142 (4)**: 576-582.
<https://doi.org/10.1016/j.ajo.2006.05.004>
22. **Bowd C, Zangwill LM, Medeiros FA, Hao J, Chan K, Lee T-W, et al.** Confocal scanning laser ophthalmoscopy classifiers and stereophotograph evaluation for prediction of visual field abnormalities in glaucoma-suspect eyes. *Invest Ophthalmol Vis Sci.* 2004; **45 (7)**: 2255-2262.
[Doi:https://doi.org/10.1167/iovs.03-1087](https://doi.org/10.1167/iovs.03-1087)
23. **Yoshida M, Ishikawa M, Kokaze A, Sekine Y, Matsunaga N, Uchida Y, et al.** Association of life-style with intraocular pressure in middle-aged and older Japanese residents. *Japanese J Ophthalmol.* 2003; **47 (2)**: 191-8.
[https://doi.org/10.1016/S0021-5155\(02\)00666-4](https://doi.org/10.1016/S0021-5155(02)00666-4)
24. **Cheung N, Wong TY.** Obesity and eye diseases. *Surv Ophthalmology*, 2007; **52 (2)**: 180-195.
<https://doi.org/10.1016/j.survophthal.2006.12.003>

Authors' Designation and Contribution

Muhammad Sadiq; Pharmacist: *Concepts, Design, Literature search, Data acquisition, Data analysis, Manuscript preparation, Manuscript editing, Manuscript review.*

Yousaf Jamal Mahsood; Assistant Professor: *Design, Literature search, Data acquisition, Data analysis, Manuscript preparation, Manuscript editing, Manuscript review.*

Waqar Ahmad; Pharmacist: *Concept, Literature search, Statistical analysis, Manuscript preparation, Manuscript editing, Manuscript review.*

Mir Azam Khan; Pharmacist: *Concept, Literature search, Statistical analysis, Manuscript preparation, Manuscript editing, Manuscript review.*

Farah Akhtar; Professor: *Design, Literature search, Data acquisition, Manuscript preparation, Manuscript editing, Manuscript review.*

